FIG. 1

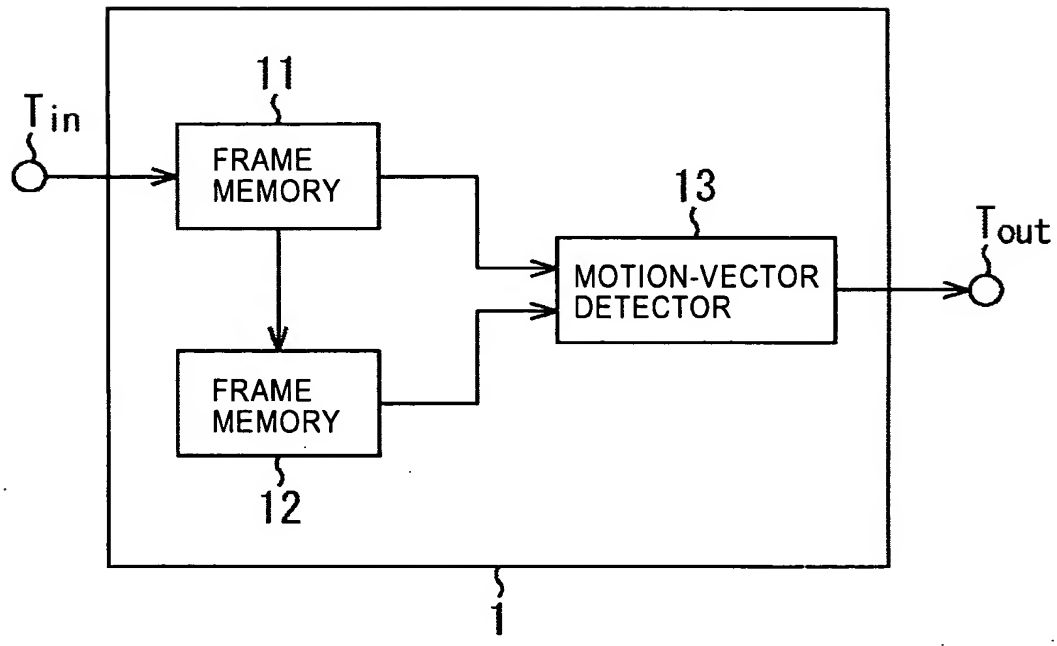

11
Tin
FRAME MEMORY
13
Tout
MOTION-VECTOR DETECTOR
FRAME MEMORY
12
1

FIG. 2

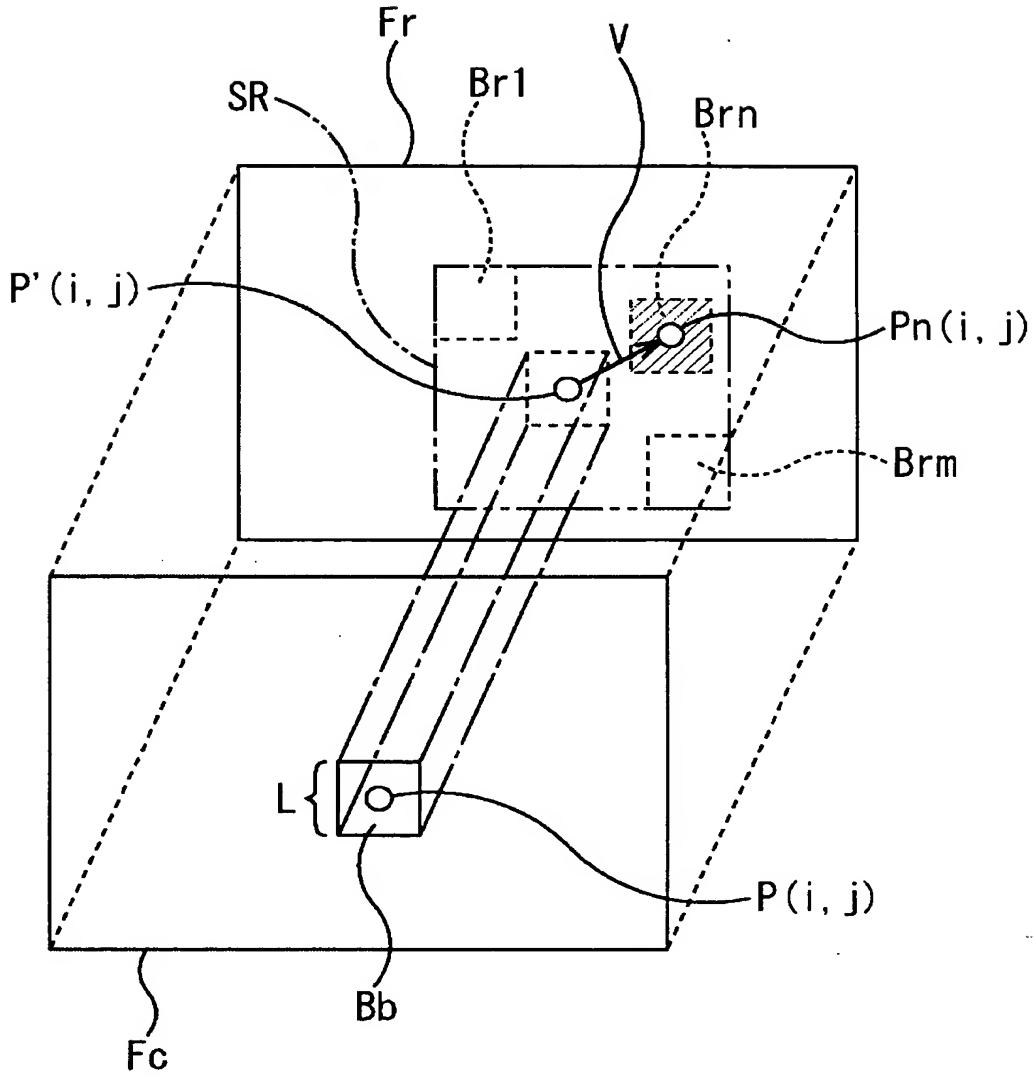
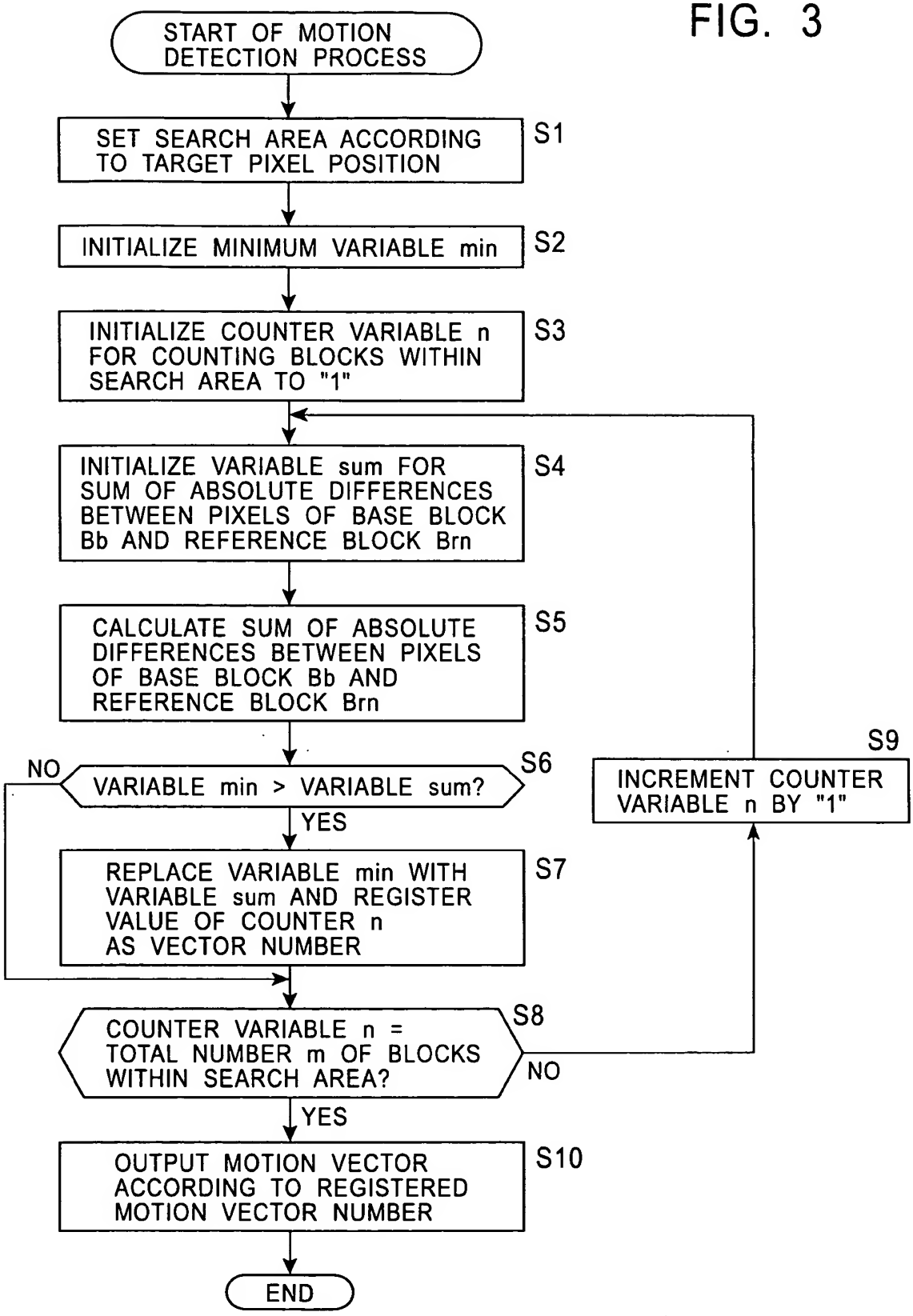


FIG. 3


START OF MOTION DETECTION PROCESS
SET SEARCH AREA ACCORDING TO TARGET PIXEL POSITION
S1
INITIALIZE MINIMUM VARIABLE min
S2
INITIALIZE COUNTER VARIABLE n FOR COUNTING BLOCKS WITHIN SEARCH AREA TO "1"
S3
INITIALIZE VARIABLE sum FOR SUM OF ABSOLUTE DIFFERENCES BETWEEN PIXELS OF BASE BLOCK Bb AND REFERENCE BLOCK Brn
S4
CALCULATE SUM OF ABSOLUTE DIFFERENCES BETWEEN PIXELS OF BASE BLOCK Bb AND REFERENCE BLOCK Brn
S5
NO
VARIABLE min > VARIABLE sum?
S6
YES
REPLACE VARIABLE min WITH VARIABLE sum AND REGISTER VALUE OF COUNTER n AS VECTOR NUMBER
S7
INCREMENT COUNTER VARIABLE n BY "1"
S9
COUNTER VARIABLE n = TOTAL NUMBER m OF BLOCKS WITHIN SEARCH AREA?
S8
NO
YES
OUTPUT MOTION VECTOR ACCORDING TO REGISTERED MOTION VECTOR NUMBER
S10
END

OBLON, SPIVAK, ET AL
DOCKET #: 243480US6
INV: Tetsujiro KONDO, et al.
SHEET 4 OF 17

FIG. 4

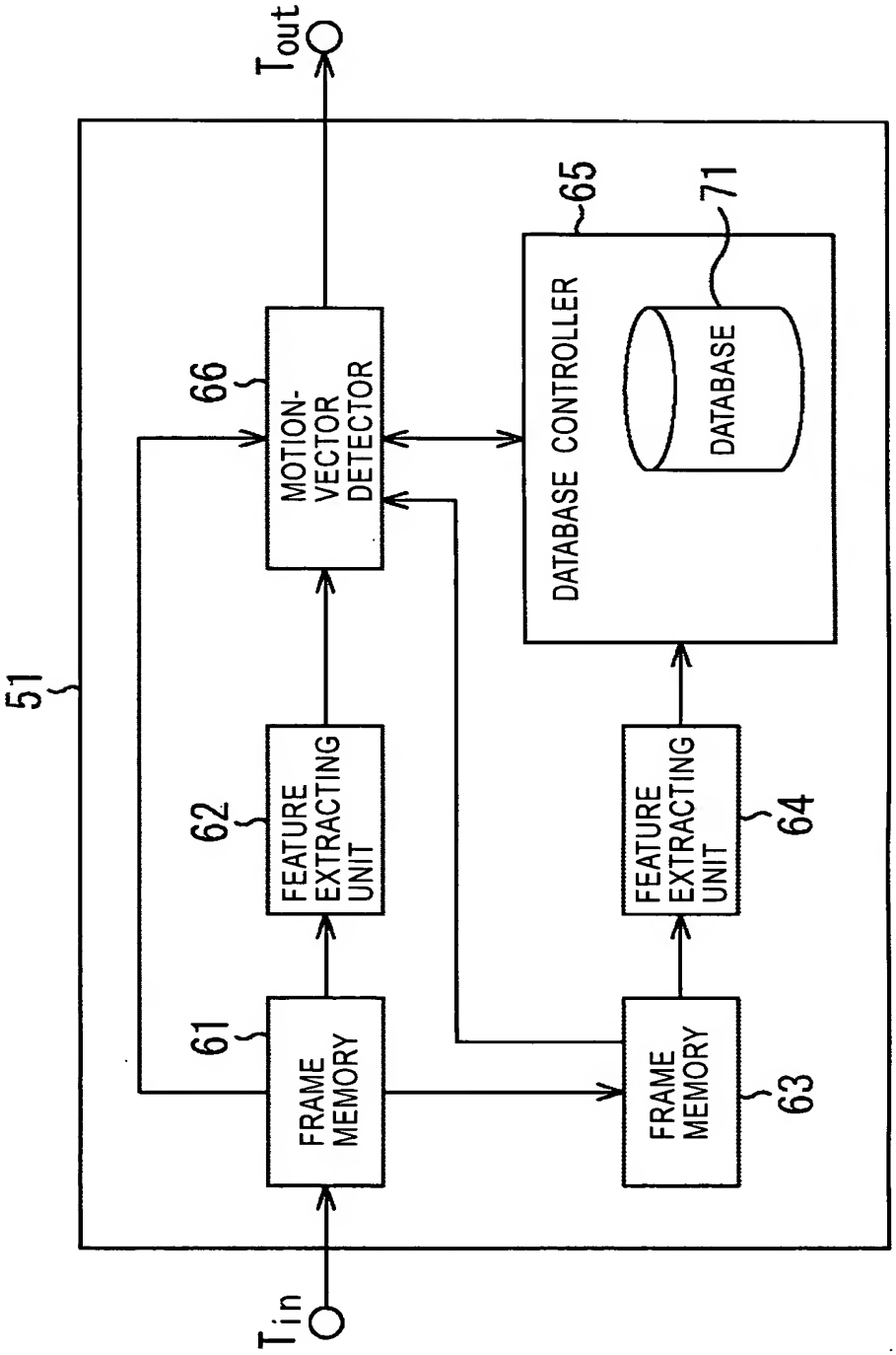


FIG. 5

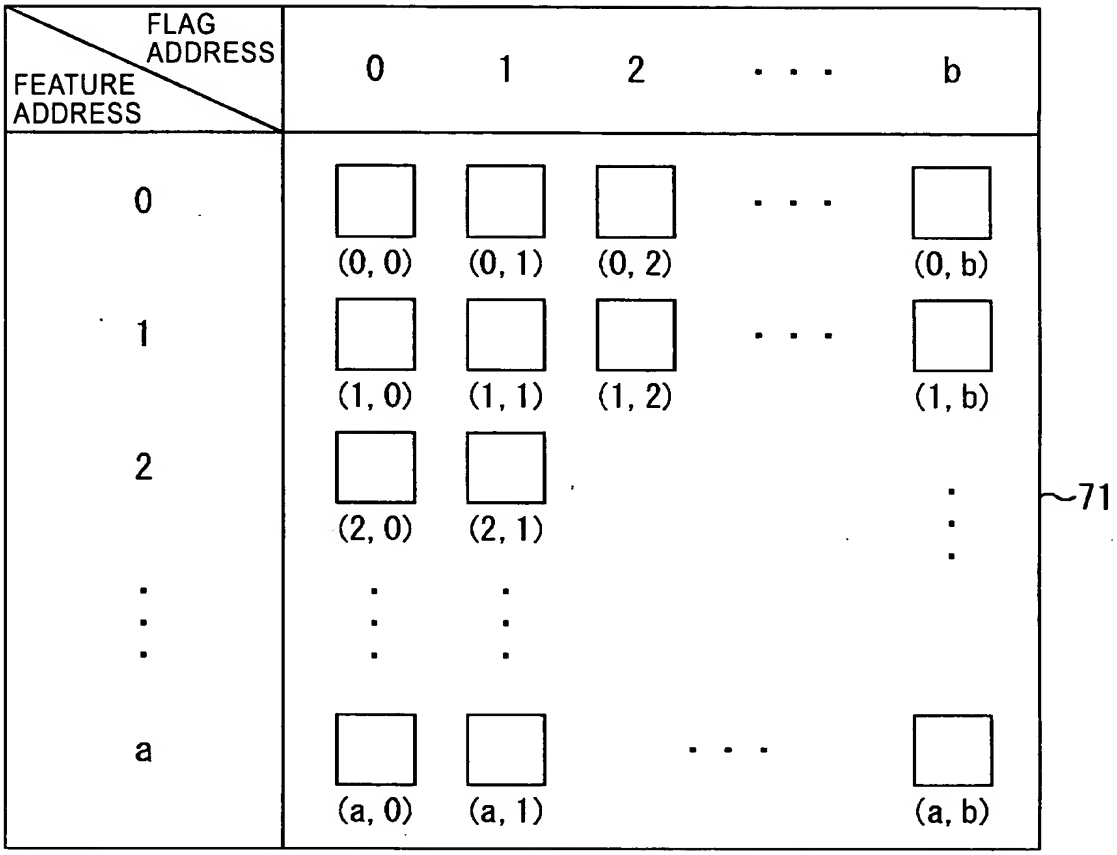

FLAG ADDRESS
FEATURE ADDRESS
0
1
2
b
0
1
2
a
(0, 0)
(0, 1)
(0, 2)
(0, b)
(1, 0)
(1, 1)
(1, 2)
(1, b)
(2, 0)
(2, 1)
(a, 0)
(a, 1)
(a, b)
71

FIG. 6

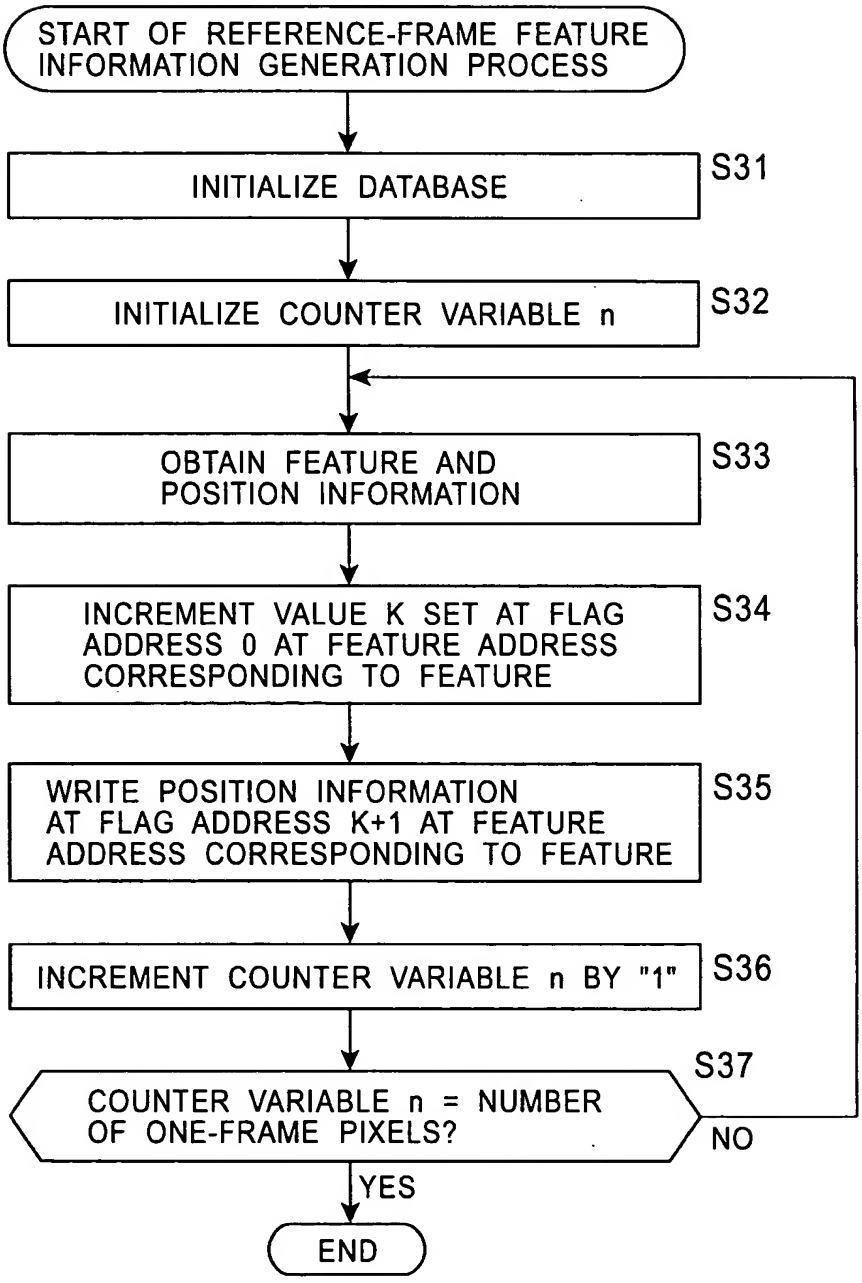

START OF REFERENCE-FRAME FEATURE INFORMATION GENERATION PROCESS
INITIALIZE DATABASE
S31
INITIALIZE COUNTER VARIABLE n
S32
OBTAIN FEATURE AND POSITION INFORMATION
S33
INCREMENT VALUE K SET AT FLAG ADDRESS 0 AT FEATURE ADDRESS CORRESPONDING TO FEATURE
S34
WRITE POSITION INFORMATION AT FLAG ADDRESS K+1 AT FEATURE ADDRESS CORRESPONDING TO FEATURE
S35
INCREMENT COUNTER VARIABLE n BY "1"
S36
S37
COUNTER VARIABLE n = NUMBER OF ONE-FRAME PIXELS?
NO
YES
END

FIG. 7

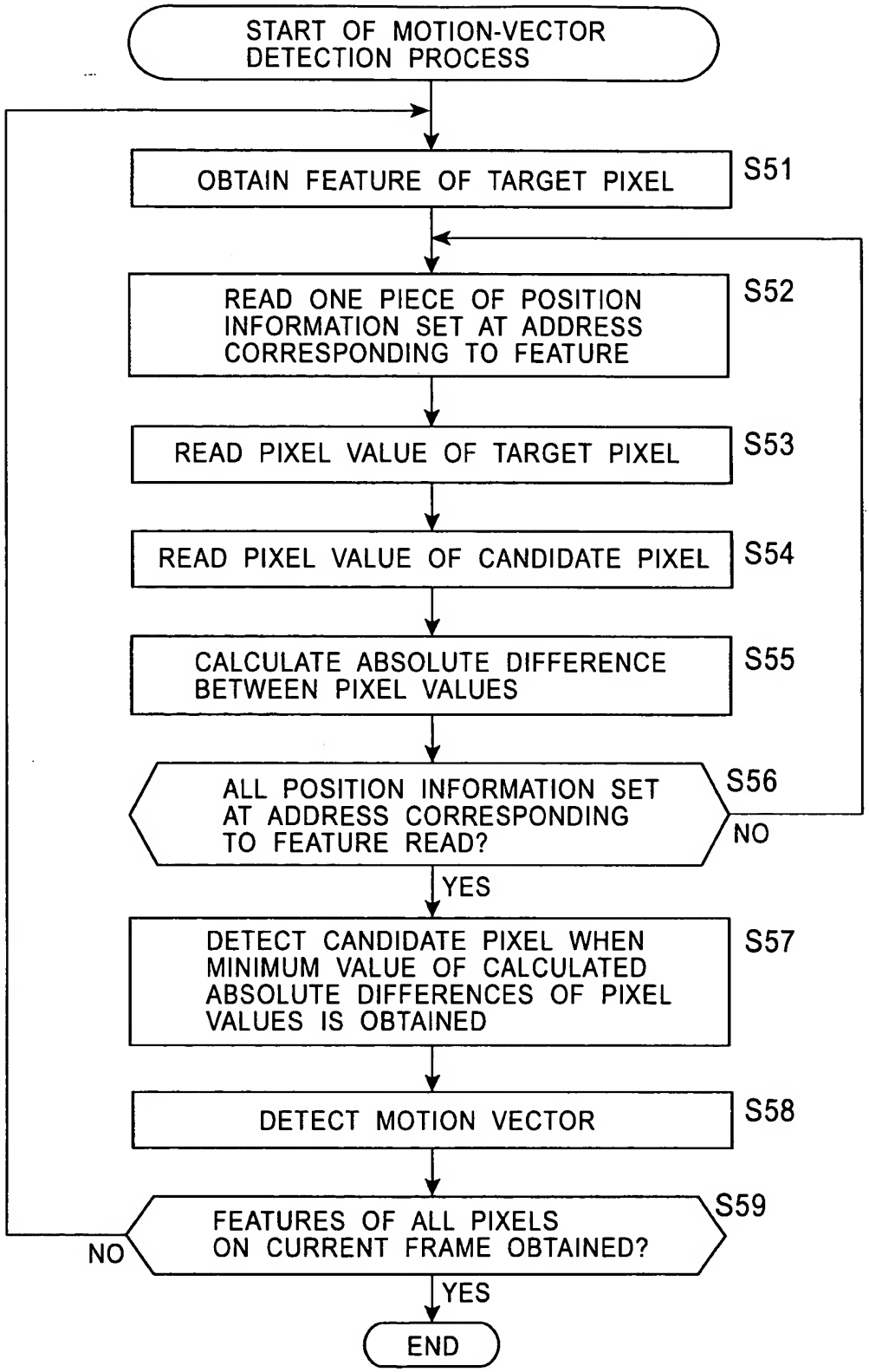

START OF MOTION-VECTOR DETECTION PROCESS
OBTAIN FEATURE OF TARGET PIXEL
S51
READ ONE PIECE OF POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE
S52
READ PIXEL VALUE OF TARGET PIXEL
S53
READ PIXEL VALUE OF CANDIDATE PIXEL
S54
CALCULATE ABSOLUTE DIFFERENCE BETWEEN PIXEL VALUES
S55
ALL POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE READ?
S56
NO
YES
DETECT CANDIDATE PIXEL WHEN MINIMUM VALUE OF CALCULATED ABSOLUTE DIFFERENCES OF PIXEL VALUES IS OBTAINED
S57
DETECT MOTION VECTOR
S58
FEATURES OF ALL PIXELS ON CURRENT FRAME OBTAINED?
S59
NO
YES
END

FIG. 8

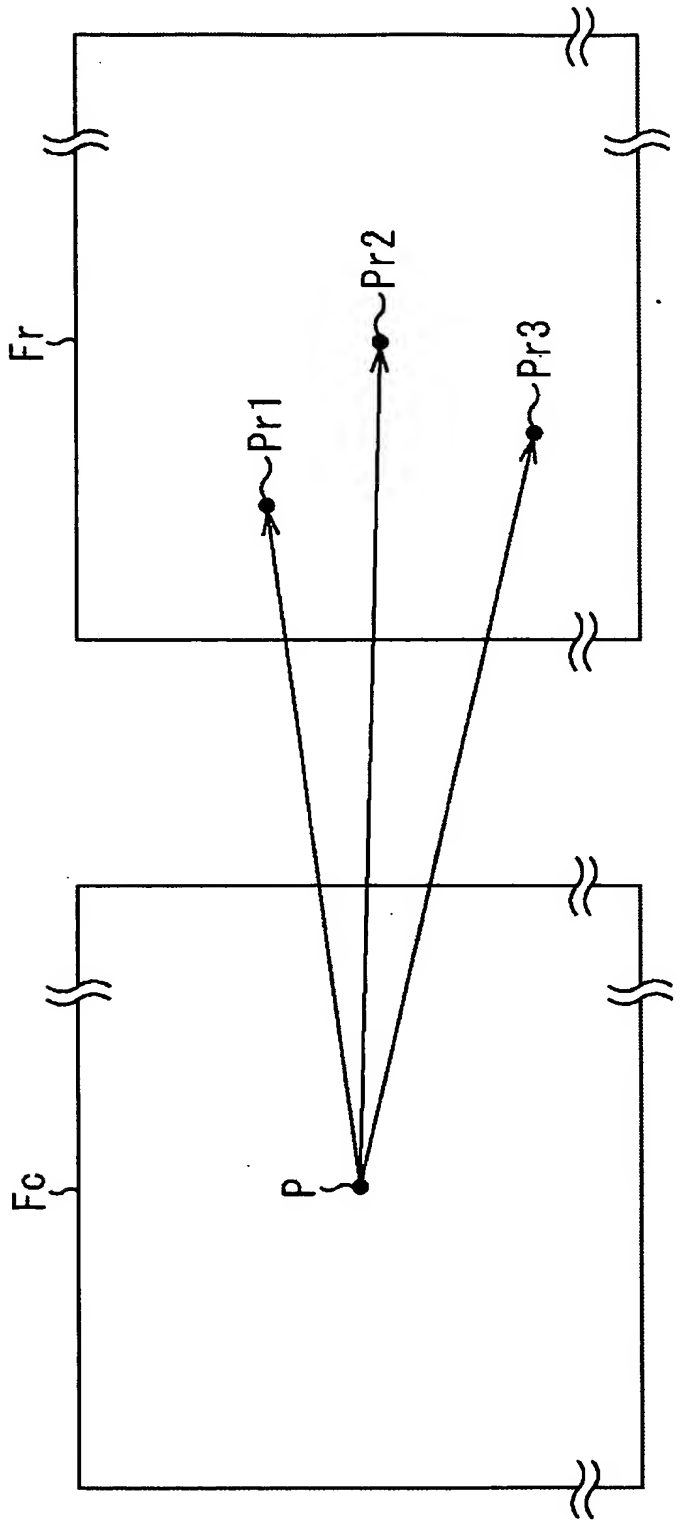


FIG. 9

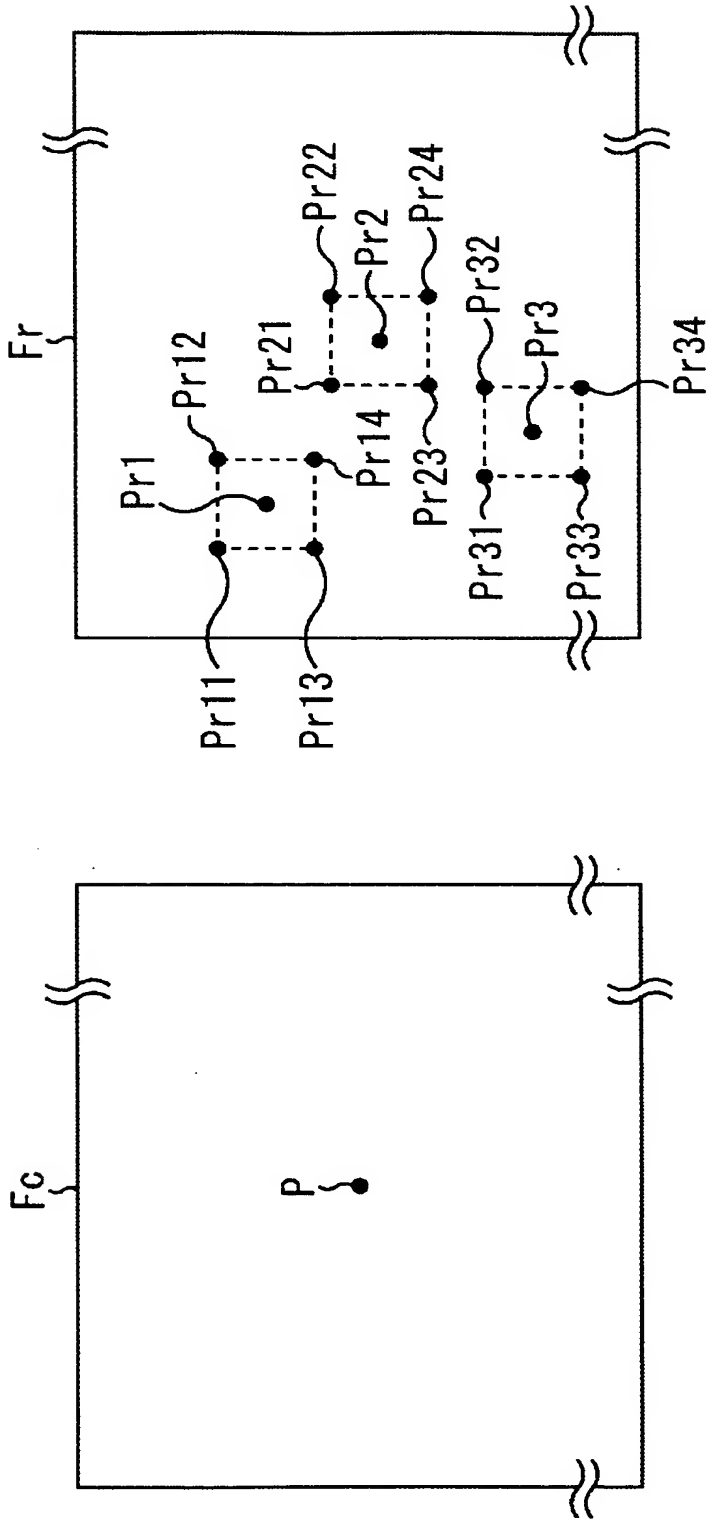

Fr
Pr1
Pr12
Pr11
Pr13
Pr14
Pr21
Pr22
Pr2
Pr24
Pr23
Pr31
Pr32
Pr3
Pr33
Pr34
Fc
P

FIG. 10

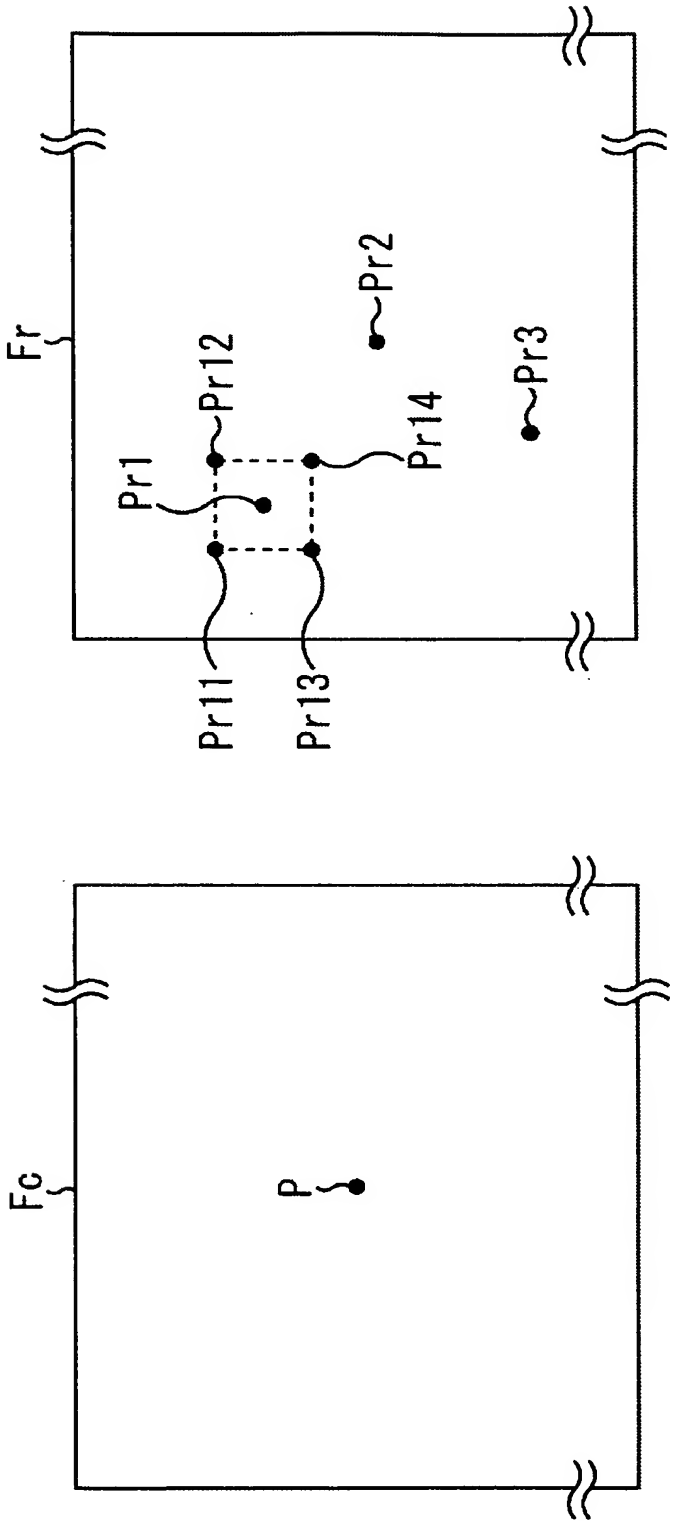


FIG. 11

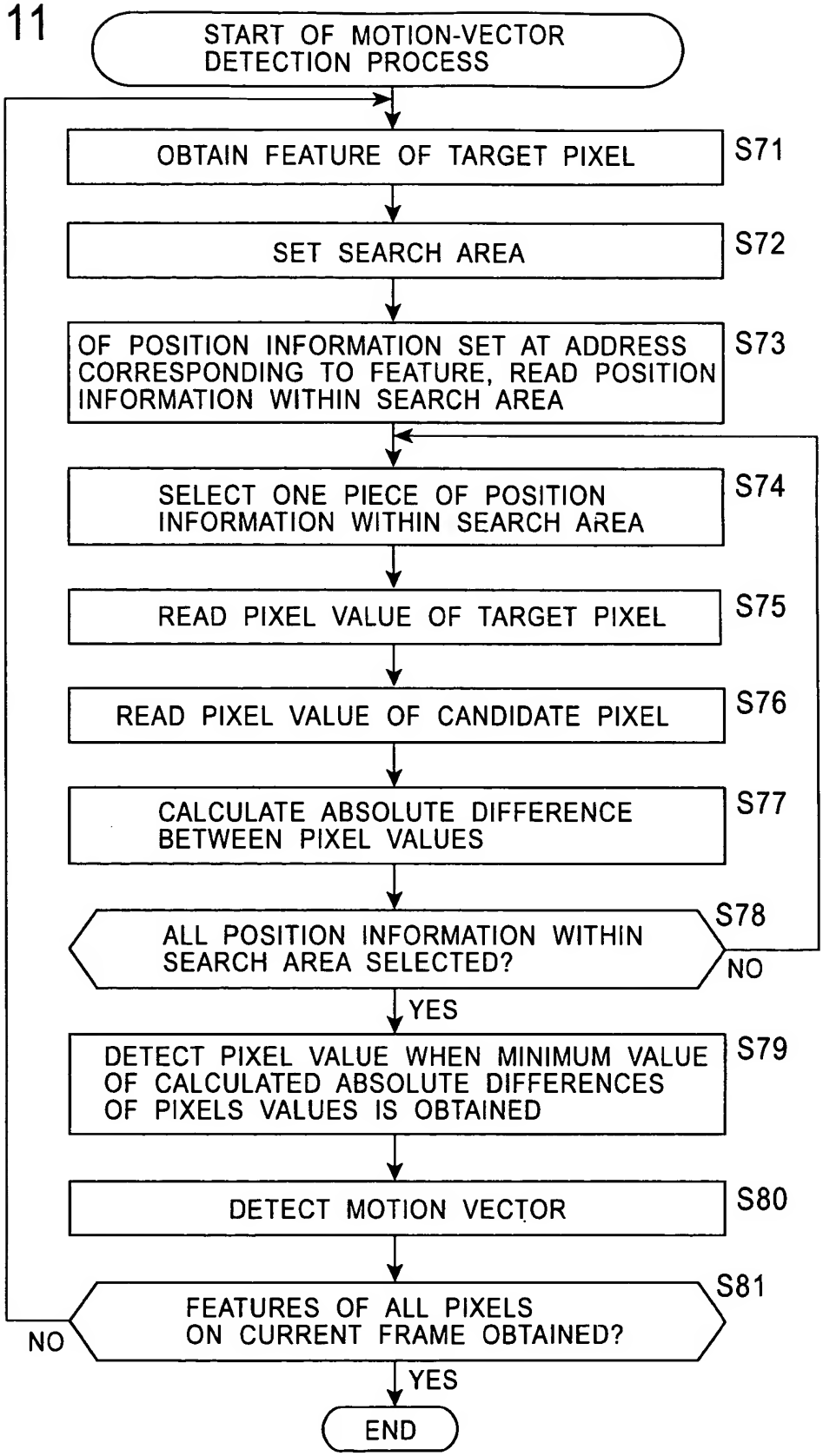

START OF MOTION-VECTOR DETECTION PROCESS
OBTAIN FEATURE OF TARGET PIXEL
S71
SET SEARCH AREA
S72
OF POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE, READ POSITION INFORMATION WITHIN SEARCH AREA
S73
SELECT ONE PIECE OF POSITION INFORMATION WITHIN SEARCH AREA
S74
READ PIXEL VALUE OF TARGET PIXEL
S75
READ PIXEL VALUE OF CANDIDATE PIXEL
S76
CALCULATE ABSOLUTE DIFFERENCE BETWEEN PIXEL VALUES
S77
ALL POSITION INFORMATION WITHIN SEARCH AREA SELECTED?
S78
NO
YES
DETECT PIXEL VALUE WHEN MINIMUM VALUE OF CALCULATED ABSOLUTE DIFFERENCES OF PIXELS VALUES IS OBTAINED
S79
DETECT MOTION VECTOR
S80
FEATURES OF ALL PIXELS ON CURRENT FRAME OBTAINED?
S81
NO
YES
END

FIG. 12

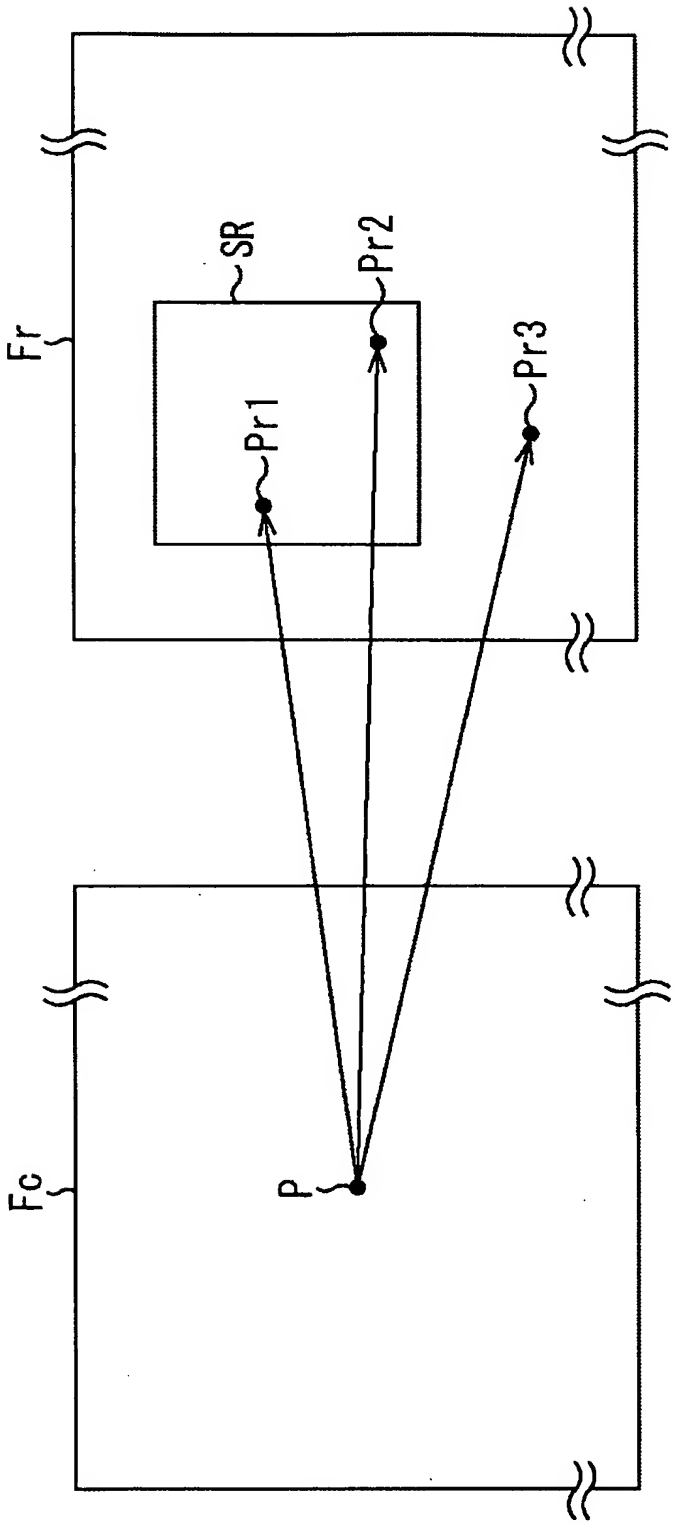


FIG. 13

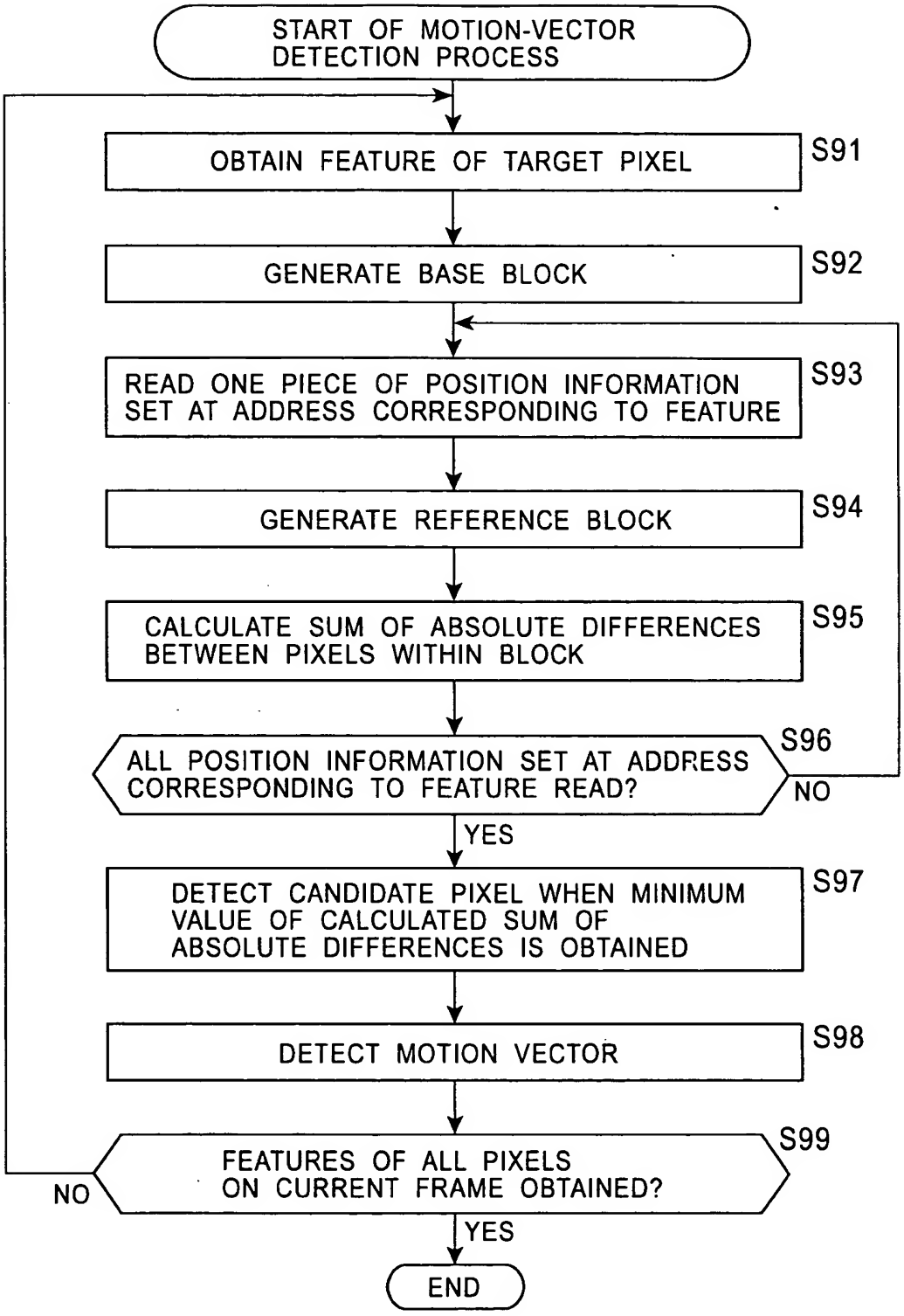

START OF MOTION-VECTOR DETECTION PROCESS
OBTAIN FEATURE OF TARGET PIXEL
S91
GENERATE BASE BLOCK
S92
READ ONE PIECE OF POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE
S93
GENERATE REFERENCE BLOCK
S94
CALCULATE SUM OF ABSOLUTE DIFFERENCES BETWEEN PIXELS WITHIN BLOCK
S95
ALL POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE READ?
S96
NO
YES
DETECT CANDIDATE PIXEL WHEN MINIMUM VALUE OF CALCULATED SUM OF ABSOLUTE DIFFERENCES IS OBTAINED
S97
DETECT MOTION VECTOR
S98
FEATURES OF ALL PIXELS ON CURRENT FRAME OBTAINED?
S99
NO
YES
END

FIG. 14

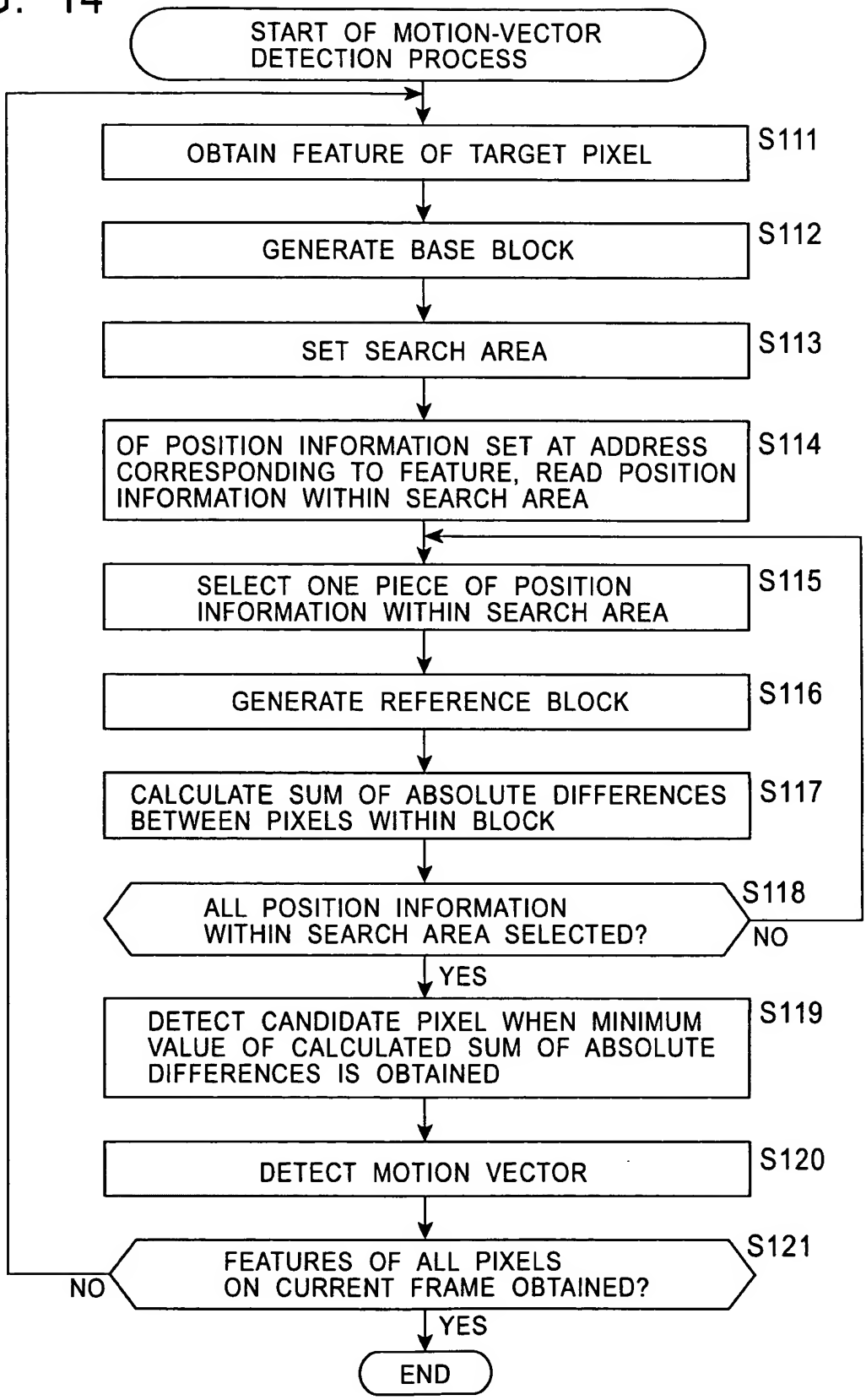

START OF MOTION-VECTOR DETECTION PROCESS
OBTAIN FEATURE OF TARGET PIXEL
S111
GENERATE BASE BLOCK
S112
SET SEARCH AREA
S113
OF POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE, READ POSITION INFORMATION WITHIN SEARCH AREA
S114
SELECT ONE PIECE OF POSITION INFORMATION WITHIN SEARCH AREA
S115
GENERATE REFERENCE BLOCK
S116
CALCULATE SUM OF ABSOLUTE DIFFERENCES BETWEEN PIXELS WITHIN BLOCK
S117
ALL POSITION INFORMATION WITHIN SEARCH AREA SELECTED?
S118
NO
YES
DETECT CANDIDATE PIXEL WHEN MINIMUM VALUE OF CALCULATED SUM OF ABSOLUTE DIFFERENCES IS OBTAINED
S119
DETECT MOTION VECTOR
S120
FEATURES OF ALL PIXELS ON CURRENT FRAME OBTAINED?
S121
NO
YES
END

FIG. 15

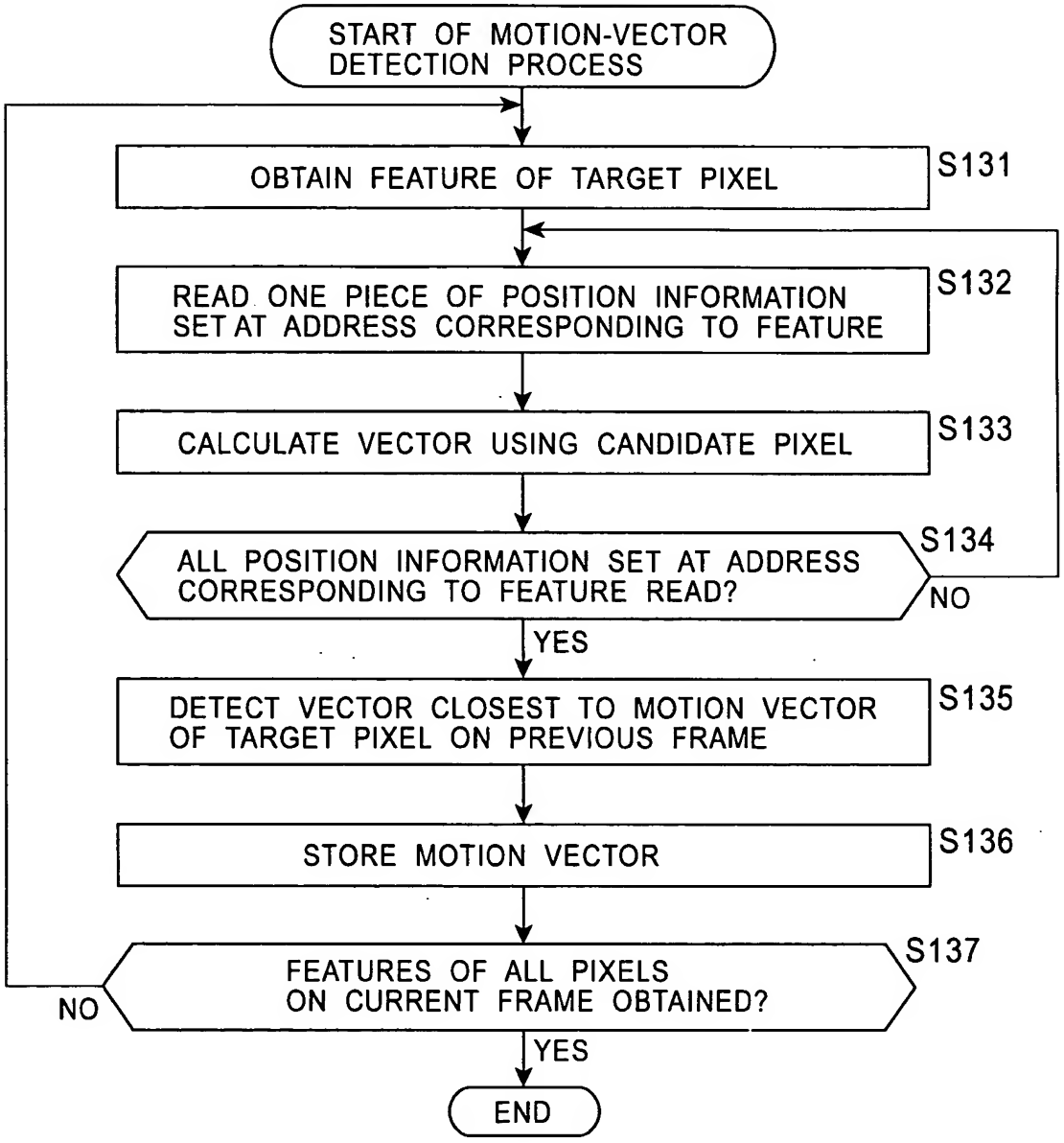

START OF MOTION-VECTOR DETECTION PROCESS
OBTAIN FEATURE OF TARGET PIXEL
S131
READ ONE PIECE OF POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE
S132
CALCULATE VECTOR USING CANDIDATE PIXEL
S133
ALL POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE READ?
S134
NO
YES
DETECT VECTOR CLOSEST TO MOTION VECTOR OF TARGET PIXEL ON PREVIOUS FRAME
S135
STORE MOTION VECTOR
S136
FEATURES OF ALL PIXELS ON CURRENT FRAME OBTAINED?
S137
NO
YES
END

FIG. 16

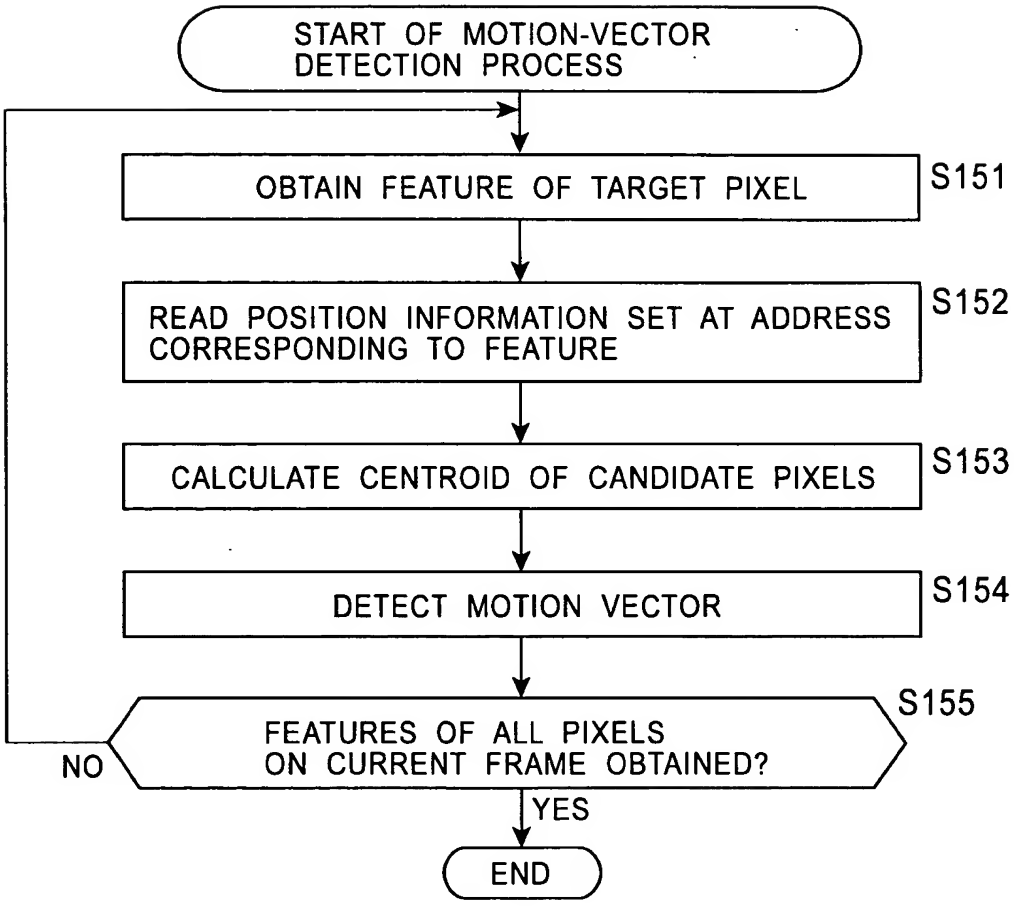
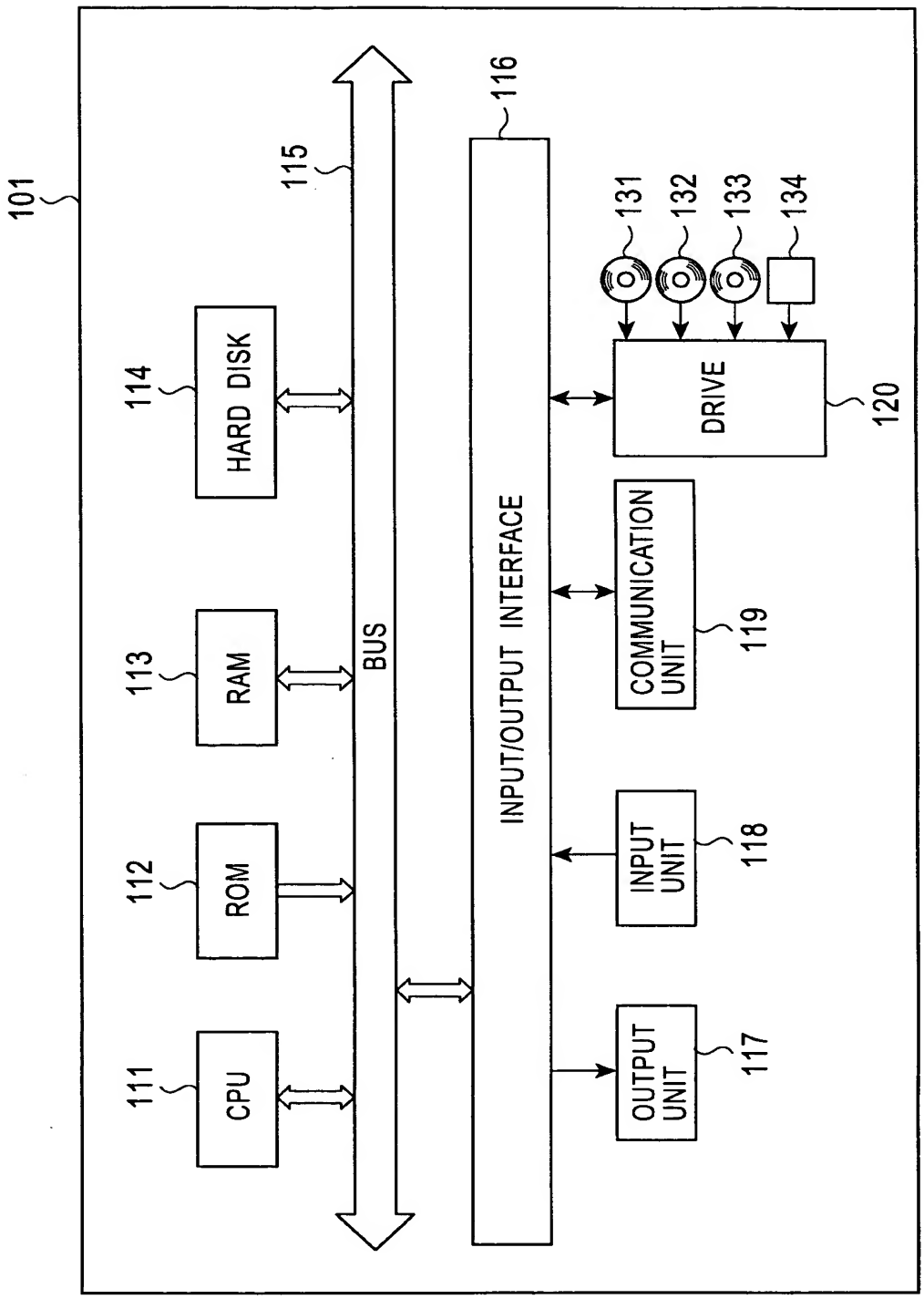

START OF MOTION-VECTOR DETECTION PROCESS
OBTAIN FEATURE OF TARGET PIXEL
S151
READ POSITION INFORMATION SET AT ADDRESS CORRESPONDING TO FEATURE
S152
CALCULATE CENTROID OF CANDIDATE PIXELS
S153
DETECT MOTION VECTOR
S154
FEATURES OF ALL PIXELS ON CURRENT FRAME OBTAINED?
S155
NO
YES
END

FIG. 17


101
115
116
131
132
133
134
114
HARD DISK
DRIVE
120
BUS
INPUT/OUTPUT INTERFACE
113
RAM
COMMUNICATION UNIT
119
112
ROM
INPUT UNIT
118
111
CPU
OUTPUT UNIT
117